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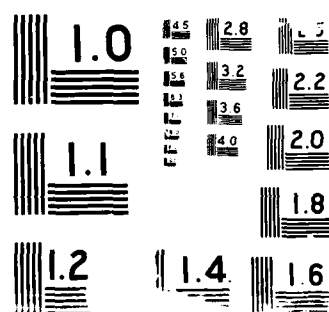
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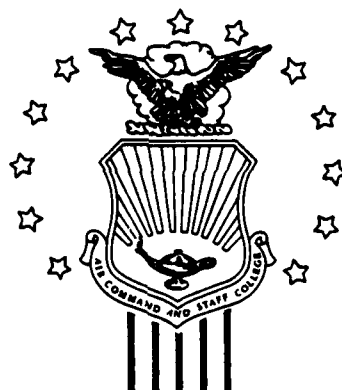




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# AIR COMMAND AND STAFF COLLEGE

## STUDENT REPORT

CLASS 2 JOINT TACTICAL INFORMATION DISTRI-  
BUTION SYSTEM (JTIDS)--A CASE STUDY IN HOW  
NOT TO RUN A RELIABILITY AND MAINTAINABILITY  
(R&M) PROGRAM DURING TEST AND EVALUATION

MAJOR WILLIAM T. BRADEN

88-0355

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**REPORT NUMBER** 88-0355

**TITLE** CLASS 2 JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS)--  
A CASE STUDY IN HOW NOT TO RUN A RELIABILITY AND MAINTAINABILITY  
(R&M) PROGRAM DURING TEST AND EVALUATION

**AUTHOR(S)** MAJOR WILLIAM T. BRADEN, USAF

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**SPONSOR** LT COL T. D. WOODRUFF, HQ AFOTEC/LG2

Submitted to the faculty in partial fulfillment of  
requirements for graduation.

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## PREFACE

Air Force Reliability and Maintainability Action Plan - R&M 2000 was enacted to increase the importance of R&M and make it equal to cost, schedule, and performance. Senior Air Force leaders have shown their commitment to improving our warfighting capability by increasing R&M. However, during test and evaluation of the Class 2 Joint Tactical Information Distribution System (JTIDS), the program office did not implement R&M 2000, and the test organization involved did not enforce implementation of R&M 2000 upon the program office. The study focuses on specific examples during testing where R&M policy was not implemented. The study concludes that if implementation of R&M 2000 is not enforced, it is no better than the policies that preceded it, and any increases in R&M will be slow at best.

I would like to acknowledge my project sponsor, Lieutenant Colonel T. D. Woodruff, HQ AFOTEC/LG2, and my advisor, Major Steve Malutich, ACSC/3824 STUS, for their support and guidance. Special thanks go to Colonel James P. Wyman and Chief Master Sergeant Pete Snieszko, AFOTEC Anti-Jam Communications Test Team, and Captain Bruce A. Johnson, HQ USAF/LE-RD, for their critical review of the project.

Subject to clearance, this manuscript will be submitted to the Program Manager and Air Force Journal of Logistics for consideration.

## ABOUT THE AUTHOR

Major William T. Braden (bachelor of arts degree from Arkansas Tech University and master of arts degree from Central Michigan University) served most recently as the deputy for logistics evaluation, Anti-Jam Communications Test Team, Air Force Operational Test and Evaluation Center, Eglin AFB, Florida. He has been the system program officer for avionics systems on the C-130, VC-10, HS-125, and HS-748 "Andovers" of "The Queen's Flight" as an exchange officer with the Royal Air Force at Headquarters Strike Command, High Wycombe, U.K.; C-130 program manager at 21 AF, McGuire AFB, New Jersey; detachment commander, Galena Airport, Alaska; and C-130 maintenance officer at Little Rock AFB, Arkansas. Major Braden began his Air Force career in 1966 as an avionics technician on the F-106 fighter interceptor. He is a graduate of Squadron Officer School and is currently attending Air Command and Staff College at Maxwell AFB, Alabama.

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## EXECUTIVE SUMMARY

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**REPORT NUMBER** 88-0355

**AUTHOR(S)** MAJOR WILLIAM T. BRADEN, USAF

**TITLE** CLASS 2 JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM (JTIDS)--A CASE STUDY IN HOW NOT TO RUN A RELIABILITY AND MAINTAINABILITY (R&M) PROGRAM DURING TEST AND EVALUATION

I. Purpose: To highlight how present reliability and maintainability (R&M) policies were not implemented during testing of the Class 2 Joint Tactical Information Distribution System (JTIDS).

II. Problem: Air Force Reliability and Maintainability Action Plan - R&M 2000, was enacted to increase the importance of R&M equal to that of cost, schedule, and performance. The program office did not implement R&M 2000, and the test organization did not enforce its implementation.

III. Data: Testing of the Class 2 JTIDS was in two phases: (1) a Developmental Test and Evaluation (DT&E) conducted by AFSC using civilian engineers and the contractor to perform maintenance, and (2) an Initial Operational Test and Evaluation (IOT&E) conducted by the Air Force Operational Test and Evaluation Center (AFOTEC) using Tactical Air Command (TAC) maintenance personnel. R&M was not emphasized during DT&E. Contractor personnel were repairing the system, but they were not collecting the detailed data necessary to trace problems so they could be resolved. Also, the organizational level built-in-test for the

## CONTINUED

system was not being evaluated by the DT&E team in relation to the requirements in AFR 80-14. OT&E maintenance personnel noticed the indifference toward R&M and confronted the program office. The program office turned down an offer of assistance and kept OT&E maintenance personnel from getting involved early in DT&E as specified in AFR 80-14. The program office was not implementing R&M policy as intended by R&M 2000, nor would AFOTEC enforce its responsibility of early involvement as pointed out in AFR 80-14.

IV. Conclusion: Because the contractor's repair data lacked traceability and accountability, he could not begin problem resolution until 11 months after DT&E started. This coincided with IOT&E maintenance personnel gaining permission to maintain the system and collect all R&M data. The program office also failed in its responsibility to develop a reliability growth plan early. Without credible R&M data from DT&E and no growth plan, the program office could not show any R&M growth during the DT&E/IOT&E or evaluate progress toward mature R&M performance. Eighteen months of testing ended in a delayed production decision until R&M requirements are satisfied.

V. Recommendation: The implementing command must ensure R&M policies are supported by the program office beginning early in the acquisition cycle. It is also imperative that the independent test organization (AFOTEC) get involved as early as policy allows. If denied early involvement, AFOTEC should enforce the policy through their direct access to the Air Staff. The Air Staff could be more personally involved at the working level. They should ensure all organizations are implementing current R&M policy and procedures; otherwise, R&M 2000 is no better than the policies that preceded it.

CLASS 2 JOINT TACTICAL INFORMATION DISTRIBUTION SYSTEM  
(JTIDS)--A CASE STUDY IN HOW NOT TO RUN A RELIABILITY AND  
MAINTAINABILITY (R&M) PROGRAM DURING TEST AND EVALUATION

Since its publication in February 1985, many articles have been written about the Air Force Reliability and Maintainability Action Plan - R&M 2000. R&M 2000 is an Air Force initiative to increase the importance of R&M and make it equal to that of cost, schedule, and performance.

For too long, the reliability and maintainability of our weapon systems have been secondary considerations in the acquisition process. It is time to change this practice and make reliability and maintainability primary considerations. Everyone must insure reliability and maintainability requirements are met through every step of the process (7:Appendix 1).

R&M 2000 brings a renewed emphasis to R&M throughout the life cycle of each system. It is a renewed emphasis because the policies and procedures on R&M prior to R&M 2000 "adequately covered R&M and provided a good basis for the injection of R&M into the acquisition process. Also, the primary Air Force implementing directive, AFR 800-18, contained most of the essential R&M program elements" (7:III-3). The writers of R&M 2000 agreed that "to gain the benefits of the R&M program, more discipline in implementing existing policy is required" (7:III-5). This is an admission that the policy always existed, but was not a priority in the past.

R&M 2000 concentrates on six key management objectives aimed at supporting the senior level commitment to R&M, convincing the Air Force and industry of the necessity of this commitment, and focusing our manpower and program resources on institutionalizing this commitment. The major objectives in R&M 2000 are:

- I. Establish clear direction for R&M improvement.
- II. Establish an organizational infrastructure to implement the essential elements of the R&M improvement program.
- III. Establish an R&M planning system to consolidate R&M efforts.
- IV. Establish a system to ensure accountability, review, and feedback.
- V. Establish a communication and motivation program.
- VI. Establish industry commitment to R&M (8:i).

R&M 2000 brings renewed seriousness to the R&M arena. Indeed, the seriousness of implementing present policy and the advocacy of R&M from

senior Air Force leaders can be seen from recent decisions they have made on important systems. The Single Channel Ground Airborne Radio System (SINCGARS) program was reviewed because it was not meeting reliability requirements. Also, the NAVSTAR Global Positioning System (GPS) user equipment contract was modified to require more stringent reliability parameters, and the Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) contract was modified to emphasize reliability (2:29). The production approval for the ALR-74 Radar Warning Receiver was delayed partly because of poor reliability (1:34). The latest system to feel the effect of this renewed emphasis on R&M is the Class 2 Joint Tactical Information Distribution System (JTIDS), which completed its Initial Operational Test and Evaluation (IOT&E) in April 1987. The Air Force delayed the production decision until the R&M requirements are satisfied. These decisions reflect the attitudes of our senior Air Force leaders, but has that attitude filtered down to the program management level where the day-to-day priorities on cost, schedule, performance, and now R&M are established? The implementing command, through the program office, establishes these priorities and, as such, is key to promoting a good R&M attitude (4:2,5).

If R&M is now equal to cost, schedule, and performance, it must be treated as such. If the program office does not implement R&M policy, then the other organizations involved (using command, testing organization, supporting command, and Air Staff) have a responsibility to enforce the policy upon the program office. Using examples from throughout the testing of the Class 2 JTIDS, this article will provide an IOT&E team perspective of how the program office failed to implement R&M policy and show how the test organization involved did little to enforce R&M policy when not implemented. Finally, this article will show the results of not implementing R&M policy and make recommendations to help preclude the same results in other programs.

Class 2 JTIDS testing was done in two phases. A Developmental Test and Evaluation (DT&E) was conducted by Air Force Systems Command (AFSC) using civilian engineers and the contractor to perform maintenance. This phase lasted from October 1985 to October 1986. The second phase was the IOT&E conducted by the Air Force Operational Test and Evaluation Center (AFOTEC) using Tactical Air Command (TAC) maintenance personnel. This phase lasted from December 1986 to April 1987.

An objective of the DT&E team was to "assess the effectiveness of the Class 2 JTIDS built-in-test (BIT)" (12:A-112, A-113). In conversations with the DT&E engineers, the OT&E maintenance personnel learned that the organizational-level BIT was not very effective in isolating discrepancies to the faulty line replaceable unit (LRU). The BIT call-outs to indicate the faulty LRUs were inconsistent and erroneous. The DT&E engineers stopped using it for troubleshooting, thereby stopping the collection of the diagnostics data necessary to trace the problems with the BIT. The implementing command is responsible to "collect, process, and evaluate reliability, maintainability, and availability data" (6:11). Since the BIT affects the maintainability and availability of the system, the DT&E team neglected their responsibility to

collect BIT data to evaluate these. The importance of an effective BIT in the operational environment was stressed to the program office, but BIT remained unchanged throughout testing. Also, the program office could have used the DT&E data to establish a baseline from which to show growth in BIT effectiveness. Without data for a baseline, they could not show any growth as improvements were made. During OT&E, the maintenance personnel had to use a faulty BIT to try to isolate discrepancies and, at the same time, gather data to assist the contractor in fixing the BIT. The faulty BIT contributed to the Class 2 JTIDS failing maintainability and availability requirements because it took longer to maintain the system, decreasing the time it was available for operation.

Also during the DT&E, the contractor failed in his responsibility to collect R&M data as he repaired the Class 2 JTIDS terminal. The contractor had total control of all terminal parts with no government personnel on the DT&E test team to monitor his actions. The contractor did not keep track of repairs, spares, problems, or corrective actions as well as they should have as required in the "Logistics Support Plan for Preoperational Support (LSPPS)." This document stated, "After terminal deployment to the T&E site, Singer-Kearfott Division (S-KD) field service engineers will prepare AFSC Forms 258 and 258-4 and field failure maintenance event reports (FFMER) for both terminals and PSE to the LRU/SRU level" (11:8-42,43). The AFSC Forms 258 and 258-4 are used to gather very detailed information on organizational- and intermediate-level repair actions. This information goes into AFSC's Systems Effectiveness Data System (SEDS) and is broken down to assist in the evaluation of R&M objectives. The contractor did not use AFSC Forms 258 and 258-4, so he lacked the detailed information they provided. To add to the problem, the contractor personnel did not fill out FFMERs on all repair actions, and those filled out were not sent to the contractor's plant for timely analysis. R&M 2000 points out that "Lack of traceability and accountability for R&M impacts and achievements are significant deficiencies in the current system" (8:7). This lack of traceability and accountability caused an 11-month delay in collecting data accurate enough for the contractor to begin problem identification and resolution. The OT&E maintenance personnel wanted to be involved in DT&E and offered to assist the DT&E team in maintaining the terminal and collecting detailed R&M data, but they were turned down by the program office and DT&E test director.

On 6 May 1986, seven months into DT&E, the OT&E test team conducted a one-day dress rehearsal mission. From this day forward the OT&E maintenance personnel were to assist the DT&E test team in maintaining the Class 2 JTIDS terminal, gradually taking over full responsibility for all maintenance and data collection. This had been coordinated with the DT&E test team and the local program office representative, and it was within the timetable specified in the "Integrated Logistics Support Plan (ILSP)" (10:8-22). The program manager visited the test site on 17 June 1986 and stopped the OT&E maintenance personnel from performing maintenance. He assured the OT&E test team they would get a couple of weeks of hands-on maintenance before OT&E started. The OT&E test team

explained that present regulations and the spirit and intent of R&M 2000 called for other commands to be involved early in DT&E.

Their purpose is to provide the implementing command with access to other command resources and expertise, to minimize duplication of testing, and to provide OT&E management with information that allows early assessment of the system's operational effectiveness and suitability, maintainability, and supportability (6:6).

AFOTEC could not make an early assessment of the Class 2 JTIDS because R&M data collected in DT&E was incomplete, and the program office would not let the OT&E maintenance personnel get involved.

This was a direct blow against R&M 2000. The program office cut out the most valuable asset to R&M during a program, the using command maintenance personnel.

An important reason for the early involvement of the maintenance technician is R&M efficiency. Aircraft mechanics are an umbilical between the flightline and the functions charged with R&M responsibility and achievement of Air Force R&M goals. These professionals are intimately familiar with the harsh maintenance environment; the frustration of poorly performing equipment, parts, or tools; and the difficulty of maintenance tasks on many weapon systems. The maintenance technician is as critical to sound R&M as the pilot tactician is to formulating new operational needs (3:10, 12).

The program office violated existing R&M policy, specifically, "The OT&E, operating, participating, and supporting commands must participate in DT&E, as specified in program directives and other planning documents" (5:6).

The planning document used to specify the use of OT&E maintenance personnel during DT&E was the "ILSP," written by the contractor for the program office, outlining the logistics plan to be used during the program. That document stated "beginning with the third month of test and evaluation (T&E), organizational and intermediate (O&I) maintenance tasks will begin to transfer to Air Force maintenance personnel, with all O&I maintenance to be performed by Air Force maintenance personnel at the beginning of the fifth month of T&E" (10:8-22). It was 11 months after DT&E started before OT&E maintenance personnel were allowed to perform maintenance.

Another DT&E responsibility is to "assess the technical risk and evaluate compliance with the specifications, in relation to operational requirements (including reliability, maintainability, and availability), life cycle costs, and schedules" (6:7). This implies that R&M is as important in DT&E as it is in OT&E. Neither the DT&E team, the contractor, nor the program office were carrying out their full responsibility toward R&M. The DT&E team was collecting only reliability data

at the organizational level, had given up on the BIT, and was not evaluating maintainability and availability as specified in AFR 80-14 (6:11). The contractor was collecting limited intermediate-level repair data on his FFMERs, not the detailed data called for in the "LSPPS." The program office, by denying OT&E maintenance personnel early involvement in DT&E, failed to allow AFOTEC the opportunity to make an early assessment of the system. It was not until 25 August 1986, when OT&E maintenance personnel began performing all maintenance and data collection, that a controlled environment existed that allowed the traceability and accountability necessary to isolate problem trends. These trends were the hard facts the contractor needed to begin problem resolution.

Another important responsibility of an Air Force-conducted DT&E is to "report reliability in relation to the approved reliability growth plan" (6:7). This statement leads one to believe that the program office should have a reliability growth plan early in the program, at least no later than the start of DT&E. When the OT&E test team realized the Class 2 JTIDS system had reliability problems, AFOTEC began asking the program office about a reliability growth plan and offered to assist. The first draft of the growth plan was seen on 11 March 1987, just 1 month before the end of the OT&E (17 April 1987). The reliability growth plan is used "to evaluate the progress made in achieving the mature system R&M performance and to estimate maintainability, availability, and logistics supportability" (6:7). To evaluate progress made toward the mature requirements, the program office needed good R&M data from DT&E to establish an R&M performance baseline. As system problems are identified and fixes verified, R&M growth occurs and that growth can be quantified and used by the reliability growth plan to evaluate progress and estimate system maintainability and availability. Without detailed R&M data from DT&E to establish an R&M performance baseline early, and without a reliability growth plan until late in OT&E, the program office could not show R&M growth or evaluate progress made toward mature requirements or estimate system maintainability and availability until testing was over. Eighteen months of testing ended with a delayed production decision until R&M requirements are satisfied. The maintenance personnel can care and the senior leadership can care, but if such apathy for regulations continues in middle management, any improvements in R&M will be slow. The time lost in problem identification during DT&E can never be made up. Unfortunately for the Class 2 JTIDS program, the problems did not stop when DT&E ended.

Even though AFOTEC was responsible for R&M during the OT&E, the program office indirectly played a role, especially during meetings of the Joint Reliability and Maintainability Evaluation Team (JRMET). During the OT&E, system discrepancies were categorized as either inherent failures, induced failures, or could-not-duplicate (CND). Inherent failures are malfunctions resulting from internal design and manufacturing characteristics. Induced failures are malfunctions resulting from other than internal design and manufacturing characteristics. Could-not-duplicate means no malfunction was confirmed. These

implementing command is responsible for "ensuring the program office chairs the JRMET and establishes a charter outlining the procedures for collecting, analyzing, and evaluating data" (4:6). A charter for the Class 2 JTIDS program was never finalized. The JRMET was chaired by the program office and had three other voting representatives, one each from the operating command, the OT&E test team, and the supporting command. Four JRMET meetings were held during OT&E with disagreements becoming progressively worse with each meeting. These disagreements centered around a basic philosophy difference between DT&E and OT&E. The program office likes to show the reliability of a system using a contractual term, mean time between failure (MTBF), which the OT&E personnel cannot use because MTBF cannot be used to communicate operational readiness requirements (5:15). MTBF does not consider two of the categories of discrepancies (induced and CND) which affect operational readiness. It considers only inherent failures, so MTBF figures make a system's reliability look better than it is operationally. At the JRMET meetings, the program office wanted to keep discrepancies out of the inherent failure category unless it was proven beyond a doubt to be an inherent problem. Many of the discrepancies encountered during OT&E could not be traced to a known cause. If there was a chance that it could be an inherent problem, it was felt, by all but the chairman, that we should err in the interest of the Air Force and call it inherent. The reasoning was that the contractor puts his efforts into fixing inherent problems and to a large extent ignores all others until later in the program. During JRMET meetings the OT&E test team perceived that the program office was more interested in a good MTBF figure than categorizing problems appropriately to get early contractor analysis. All system problems must be surfaced at the JRMET or they will not get resolved by the contractor.

The problems experienced during JTIDS testing are indicative of the types of problems R&M 2000 was meant to confront. The fact that these problems occurred as much as two years after the inception of R&M 2000 indicates that some business-as-usual is still going on, and R&M policy is not being enforced by all. The writers of R&M 2000 discovered "it was not a lack of policy or procedural guidance that impeded R&M improvement. Ineffective implementation of current R&M guidance and the low priority assigned to many R&M tasks outlined in existing regulations was a problem" (7:III-5). The regulations referenced in this article, although updated after the Class 2 JTIDS program began, contained the same R&M requirements when the Class 2 JTIDS program began as they do now. Program office actions during the test indicated ineffective implementation of R&M policy, and the program office was assigning a low priority to R&M by denying the OT&E test team early involvement in DT&E.

The OT&E test team requested assistance from HQ AFOTEC to get the program office to allow the test team early involvement in DT&E (13:1-3), but they would not intervene. If the renewed emphasis of R&M 2000 is not enforced, then it is no better than the regulations that preceded it.



The influence of the program office during Class 2 JTIDS testing was indeed negative. The OT&E maintenance personnel should be allowed to perform maintenance early in DT&E. This would subject the system to the operational aspects of the using command's maintenance concept, and all R&M data would be collected in a controlled environment for traceability and accountability. The program office should monitor the contractor to see that contractual obligations for R&M are met during DT&E. Because the contractor did not conduct a credible R&M program and the OT&E maintenance personnel were not allowed to assist, problem identification was delayed. It is the responsibility of the program office, as chairman of the JRMET meetings, to foster a problem identification atmosphere so the contractor can begin resolving problems as they are identified. Finally, the reliability growth plan should be developed and implemented before DT&E, so the problems fixed during DT&E and OT&E can be shown as growth and that growth used to evaluate progress of R&M performance toward the mature requirements.

During the Class 2 JTIDS DT&E/OT&E, the program manager did not implement R&M policy, and the independent test organization did not actively pursue its responsibility of getting involved in DT&E early. These organizations should have either implemented or enforced the implementation of present policy. The responsibility for initial implementation is with the implementing command (AFSC). The importance of the program office in this role has already been shown. The implementing command should ensure current R&M policy is taught to each program manager as outlined in R&M 2000 (8:4, 9-10), stressing the importance of implementing that policy immediately. The independent test organization (AFOTEC) was formed to ensure that systems under development are evaluated properly and the results not biased. As a result, it is their responsibility to get involved as early in the acquisition process as prescribed by current policy. The Department of Defense component's operational test agency (OTA) shall "monitor, participate in (as appropriate), and review the results of developmental test and evaluation (DT&E) for information applicable to OT&E objectives" and "ensure that operational testing and applicable development testing data collected are sufficient and credible to support analysis and evaluation requirements" (9:5). By getting involved early, AFOTEC can ensure that R&M is taken into account and can force implementation of current R&M policy through their direct access to the Air Staff. It is their responsibility to "bring directly to the attention of the Military Service Chief or Defense Agency Director issues impeding T&E" (9:6).

The Air Staff could be more personally involved, very early, at the working level, to ensure R&M policy implementation. R&M 2000 tasks the Air Staff to "establish Air Force review of command and weapon system R&M activities through active staff assistance and IG surveillance to assess the degree of compliance with R&M policy and procedures, to assist commands in building effective R&M programs, and to evaluate R&M 2000 implementation effectiveness" (8:8). Go to the field and talk to personnel from the using command, supporting command, and test organization to see if all organizations are implementing current R&M policy and procedures. You may be surprised.

An increase in combat capability is the reason everyone should want to implement R&M policy and procedures. R&M 2000 highlights our past lack of implementing R&M policy and tasks appropriate agencies with those actions necessary to enhance R&M within the Air Force. Increased R&M equals increased combat capability. A system can have all the capability we need, but if we can't fix it and keep it working for the operator, that capability is lost.

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